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XIV. *A Letter from Mr. Peter Dollond, to Nevil Maskelyne, F. R. S. and Astronomer Royal; describing some Additions and Alterations made to Hadley's Quadrant, to render it more serviceable at Sea.*

Reverend Sir,

Read March 29, 1772. **T**HE particular attention, you have always shown to any improvement tending to the advantage of astronomy or navigation, makes me take the liberty to trouble you with an account of some additions and alterations I have lately made to the Hadley's quadrant.

The general use of this instrument at sea is so well known, that no mention need be made of the importance of any improvements in the construction, that may render the observation more exact, and occasion more frequent opportunities of making them.

The glasses of the Hadley's quadrant should have their two surfaces perfect planes, and perfectly parallel to each other. From several years practice in grinding these glasses, I have found out methods of making them to great exactness; but the advantage, that should arise from the goodness of the glasses,  
has

has oftentimes been defeated by the index glass being bent by the brass frame that contains it: to prevent this, I have contrived the frame, so that the glass lies on three points, and the part that presses against the front of the glass has also three points exactly opposite to the former. These points are made to confine the glass by three screws at the back, that act exactly opposite to the points between which the glass is placed. This little contrivance may be of some use; but the principal improvements are in the methods of adjusting the glasses, particularly for the back observation.

The method hitherto practised for adjusting that part of the instrument, by means of the opposite horizons at sea, has been attended with so many difficulties that it has scarce ever been used; for so little dependance could be made on the observations taken this way, that the best Hadley's sextants made for the purposes of observing the distances of the Moon from the Sun or fixed stars, have been always made without the horizon glass for the back observation; for want of which, many valuable observations of the Sun and Moon have been lost, when their distance has exceeded 120 degrees.

To make the adjustment of the back observation easy and exact, I have applied an index to the back horizon glass, by which it may be moved into a parallel position to the index glass, in order to give it the two adjustments, in the same manner as the fore horizon glass is adjusted. Then, by moving the index to which the back horizon glass is fixed, exactly 90 degrees (which is known by the divisions made for that purpose) the glass will be thereby set

at right angles to the index glass, and consequently will be properly adjusted for use, and the observations may be made with the same accuracy by this, as by the fore observation.

To adjust the horizon glasses in the perpendicular position to the plane of the instrument, I have contrived to move each of them by a single screw, that goes through the frame of the quadrant, and is turned by means of a milled head at the back, which may be done by the observer while he is looking at the object.

To these improvements, Sir, I have added your method of placing darkening glasses behind the horizon glasses, which you have been so kind as to give me liberty to apply to my instruments. These glasses, which serve for darkening the object seen by direct vision, in adjusting the instrument by the Sun or Moon, I have placed in such a manner as to be turned behind the fore horizon glass, or behind the back horizon glass, that they may be used with either; there are three of these glasses of different degrees of darkness; the lightest or palest I do imagine will be of use in taking the Sun's altitude when the horizon appears glaring, which I believe often happens by the reflection of the sea.

If these additions and alterations should be thought to be real improvements, which I cannot doubt, Sir, if they are honoured with your approbation, I hope they may serve in conjunction with those improvements you have made yourself in respect to the obviating any possible errors in the parallelism of the planes of the index glass, and in regard to the adjustment of the telescope parallel to the plane of the

quadrant, to extend the use of this most valuable nautical instrument, and to add to the exactness of the celestial observations taken with it to determine the longitude at sea. But of these particulars I need say no more, since you are, without doubt, in every respect, the properest person to give an account of them.

I am, S I R,

Your most obedient,

humble servant,

London, February 25,  
1772.

Peter Dollond.